REMARKS

Claims 21-40 are pending in the application. Applicants thank the Examiner for allowance of claims 21-28, 34-36 and 40.

Response to Claim Rejections Under 35 U.S.C. § 102

Claims 29-33 and 37-39 are rejected under 35 U.S.C. § 102(b) as allegedly being unpatentable over Lee et al. (U.S. Patent No. 6,844,604).

As an initial matter, Applicants respectfully submit that Lee is a reference under 35 U.S.C. § 102(e), and not a reference under 35 U.S.C. § 102(b).

Present claim 29 recites a semiconductor device comprising a gate insulating film and a gate electrode stacked in this order, and in contact with each other. As recited in claim 29, the gate insulating film comprises a nitrogen containing high-dielectric-constant insulating film in which nitrogen is introduced into metal silicate and a nitrogen atom selectively bonds with a silicon atom in metal silicate.

In contrast, Lee does not disclose a metal silicate layer which contains nitrogen selectively bonded to silicate. At column 2, lines 54-57, Lee teaches that the metal silicate layer is formed of

> "metal silicate material ($M_{1-x}Si_xO_2$) and the metal "M" can be hafnium (Hf), zirconium (Zr), tantalum (Ta), titanium (Ti) or aluminum (Al)."

Although at column 2, lines 13-17, Lee discloses the use of a oxynitride layer interposed between a silicon substrate and a high-*k* dielectric layer, it does not disclose that the silicate layer contains nitrogen.

Furthermore, in the present invention of claims 29-32, a nitrogen atom in a high-dielectric-constant insulating film selectively bonds with a silicon atom in a metal silicate. Such a structure can be formed using nitridation treatment with nitrogen plasma, for example, as described in Example 2 of the present specification. In Example 2, using a RCR plasma source, active nitrogen formed from nitrogen gas is applied to a silicate film. The condition for irradiation is that the substrate temperature is 300°C, the nitrogen partial pressure is 6.7 Pa and the additional power supply is 60W for 1 minute. The nitrogen atom can selectively bond with the silicon atom by the above-described nitridation treatment, to form a silicate film containing 10 atomic % of nitrogen. As a result, the nitrogen introduction improves a thermal stability of MOSFET without deteriorating the mobility and the reliability and without increasing the leakage current. In addition, the nitrogen introduction suppresses the dopant penetration from polysilicon gate electrode.

In contrast, in Lee the above structure and nitridation treatment are not described. Particularly, as described in column 6, lines 49-62 of Lee et al., the structure of Fig. 2 comprises the semiconductor substrate 10, the silicate interface layer 12, the metal-oxide layer 18, the metal-oxide layers 20 and 22, and the polysilicon layer 24. In Fig. 2 of Lee, the nitrogen atom is not contained in the high-dielectric-constant insulating film. Therefore, the structure of the present invention of claims 29-32 is not disclosed in Fig. 2 of Lee, and a person of ordinary skill in the art cannot achieve the effects of present claims 29-32 based on the teachings of Lee.

Turning to claim 37, present claim 37 recites a semiconductor device comprising a gate insulating film and a gate electrode stacked in this order, and in contact with each other. The

gate insulating film has a layered structure having, from the silicon substrate side, a first silicon oxide film, a metal oxide film or a metal silicate film and a second silicon oxide film, and only the second silicon oxide film has a structure in which nitrogen is introduced into silicon oxide.

The gate insulating film **15** of Lee encompasses the silicate interface layer **12** and the high-k dielectric layer **14**. Silicate interface layer **12** is made of a metal silicate $M_{1-x}Si_xO_2$, where the metal "M" can be Hf, Zr, Ta, Ti or Al. The high-k dielectric layer **14** is a multilayered structure where HfO_2 or ZrO_2 layers alternate with Al_2O_3 layers, with the topmost layer preferably being Al_2O_3. At column 8, lines 30-35, Lee teaches that

> "the present invention provides a dielectric layer structure having the advantages of silicon dioxide but without the disadvantages of the prior art."

Therefore, Lee teaches away from using SiO_2 as a dielectric layer.

Additionally, although at column 2, lines 13-17, Lee discloses the use of a oxynitride layer interposed between a silicon substrate and a high-k dielectric layer, it does not disclose that it is only the second silicon oxide film that has nitrogen, as is presently claimed.

Therefore, Lee does not teach each and every element of claim 37, and claim 37 is patentable over Lee. Claims 38-39 are also patentable, at least by virtue of their dependence from claim 37.

In view of the above, Applicants respectfully request reconsideration and withdrawal of the § 102 rejection of claims 29-33 and 37-39 based on Lee.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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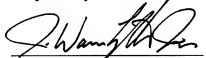
Respectfully submitted,



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